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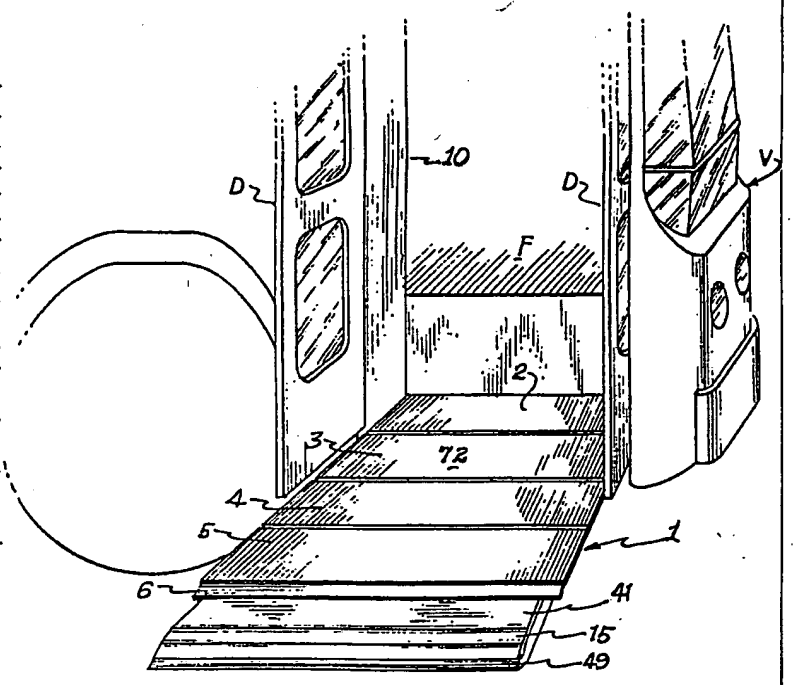
(54) Title: WHEELCHAIR LIFT

(57) Abstract

A lift device particularly suitable for hoisting handicapped persons with or without wheelchairs, into a vehicle. The lift can be installed into the door well of a public transit bus or of a railroad car. It could also be incorporated into a step structure inside a building. The lift platform (72) is made of four hinged, parallel sections (2, 3, 5) which in the stowed position of the lift fold back to form two steps (A, B). The first parallel section (2) which in the uppermost position of the platform meets the vehicle floor (F), or the upper step landing in a building, rotates along its forward edge to form the back of the upper step (B) in the stowed position. The second section (3) becomes the tread of the upper step (B) while the third section (4) forms the riser between the upper and lower steps. The fourth section (5) which forms the tread of the lower step (A), houses an access ramp along its forward edge and a retractable flap (15) which rotates upward to form an angled stop preventing the wheelchair from rolling back off the platform during motion of the lift. The load-carrying platform is supported by a moving carriage connected to the infrastructure of the lift by a linkage assembly featuring plastic bearing blocks slidingly engaged into vertical channels. In addition to its vertical lifting movement, the platform can be tilted downward from its normally horizontal position in order to accommodate slight differences in elevation between the ground and landing surfaces.



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Description

Wheelchair Lift

Prior Application

This application is a continuation-in-part of U.S. application No. 04,943,

filed on May 24, 1979.

Prior Art

The basic concept of forming the load-carrying surface of a lift platform in the entrance well of a vehicle or building was disclosed in my U.S. Patent No. 4,027,807 and No. 4,081,091. Additional improvements to this basic concept were disclosed in my U.S. Patent No. 4,176,999. Furthermore, that concept was incorporated in a device manufactured by the Vapor Corporation under the name "Travelift", and similar wheelchair lifts manufactured by various entities throughout the United States and Canada. Prior use of movable steps for purposes other than to form a lifting platform can be seen in U.S. Patents Nos. 4,020,920, Abbott; 3,957,284, Wright; 3,955,827, Wonigar; ;3,913,497, Maroshick; and 3,572,754, Fowler. Prior attempts to install hoisting devices in the step wells of buses are disclosed in U.S. Patents Nos. 4,022,337, Eichenhofer, et al; 3,918,596, Ward; 3,912,048, Manning; and 3,710,962, Fowler, Jr.

Technical Field

This invention relates to loading mechanisms, and more particularly to lift devices suitable for hoisting handicapped persons with or

without wheelchairs into vehicles such as buses or other types of public conveyance. It is also related to lift devices suitable for helping such persons in negotiating steps at the entrance of, within, or without a building. Lift devices which in the past were designed for vehicular use were relatively bulky and cumbersome, taking up a great deal of space in the interior of such vehicles. It is clearly preferably to have the lift devices completely contained in the vehicles when such vehicles are in motion. The large size of previous lift mechanisms has often necessitated external location of at least a portion of such equipment. The portion of such lift mechanism located inside the vehicle has often greatly reduced its cargo capacity. Furthermore, the size and complexity of such lift mechanism often requires that a special opening be cut into the side of the vehicles, in addition to the normal entrances, in order to accommodate the installation of the lifts.

Attempts have been made to install such a lift within the door well of a public transit bus. To that effect, various ingenious ways were devised for moving the normal entrance steps away from the path of the lift platform as shown for instance in U.S. Patent No. 4,022,337, Eichenhofer. My original design disclosed in U.S. Patent No. 4,027,807 which teaches how the tread and riser elements of the entrance steps can be recombined to form the load-carrying surface of the lift platform not only eliminated the need to stow away the

step elements but very conveniently uses those step elements as the basic components of the lift platform.

In some cases, however, it was found that the tread and riser elements were too narrow to provide a platform length sufficient to accommodate a wheelchair. Additional platform space has been provided by stretching the width of one of the step elements; or by adding a ramp sliding forward from under the step structure in order to extend the length of the platform.

Lift devices designed to be used by handicapped persons must understandably be extremely stable, free of jerking or bouncing motions, weatherproof, and extremely reliable. Meeting these requirements is made particularly difficult in lift devices having an extended platform designed to accommodate a wheelchair, with a load-carrying surface cantilevered from the side of the vehicle. The weight and size of the lift infrastructure necessary to meet these requirements are such that they could not be conveniently installed but in the largest type of public conveyance media.

This invention is the result of a search for a more efficient way to expand the width of the lift platform, while increasing the stability and smoothness of the ride and reducing the weight and size of the lifting mechanism and necessary infrastructure.

Summary of the Invention

The principal object of this invention is to provide a hoisting

device for handicapped persons which can be easily installed within the entry well of a conventional public transit vehicle. Another object of the invention is to provide such a lift which uses as part of its load-carrying platform the treads and risers of the normal entrance steps. An additional object of this invention is to provide means for extending the width of the platform beyond the load-carrying surface provided by such step elements. A further object of the invention is to reduce the weight and size of the lift supporting infrastructure to unobtrusive dimensions. It is also the object of this invention to provide a novel type of sliding bearing surface featuring lightweight, simplicity of construction, great stability, and durability.

These and other objects are achieved by replacing the normal entrance steps of a vehicle with a structure comprising a load-carrying platform made of four parallel sections. The sections are hinged together so that they can be folded into two steps in the stowed position of the lift. The outermost section of the platform becomes the tread of the lower step. The next section becomes the riser between the lower and upper step. The third section forms the tread of the upper step, while the last or innermost section of the platform is folded back behind the upper step. The supporting framework and lifting mechanism are packaged in two unobtrusive columnar assemblies conveniently installed along each side of the step well, and do not interfere with the normal use and operation of the vehicle. Sliding connection

between the moving elements of the lift and the supporting infrastructure use elongated plastic block bearings captured into vertical channels. A rotating flap around the outer edge of the platform can be lowered to act as an exit ramp for a wheelchair. It can also be rotated upward to act as a stop preventing the wheelchair from falling off the platform during lifting motion.

Description of the Drawings

Figure 1 is a perspective view of a wheelchair lift installed in the front door well of a transit bus, shown in the stowed step position;

Figure 2 is a perspective view of the wheelchair lift illustrated in Figure 1 with the load-carrying platform deployed and lowered halfway toward the pavement;

Figure 3 is a front elevational view of the wheelchair lift in the uppermost platform position;

Figure 4 is a cross sectional view taken along lines 4-4 of Figure 3;

Figure 5 is a cross sectional right side view of the wheelchair lift in the platform stowed, i.e., steps position with alternate positions of the platform shown in broken lines;

Figure 6 is a cross sectional left side view of the platform elements in their stowed, i.e., step position;

Figure 7 is a partial cross sectional front view taken along line 7-7 of Figure 6;

Figure 8 is a cross sectional left side view of the platform elements in a semi-deployed position;

Figure 9 is a cross-sectional left view of the platform elements in their fully deployed position;

Figure 10 is a top cross sectional view taken along lines 10-10 of Figure 3 with partially cut away sections showing the platform forming mechanism;

Figure 11 is a front cross-sectional view taken along line 11-11 of Figure 10;

Figure 12 is a partial front cross sectional view taken along line 12-12 of Figure 10;

Figure 13 is a top plan view of the wheelchair with the platform fully deployed with partially cut away section exposing the platform forming mechanism;

Figure 14 is a partial lateral cross sectional view of the forward end of the platform with the stop flap in the horizontal position;

Figure 15 is a similar view with the stop flap in the erect position;

Figure 16 is a lateral cross sectional view of the device limited to the platform tilting mechanism shown in the step position;

Figure 17 is a similar view showing the platform in the deployed horizontal position;

Figure 18 is a similar view showing the platform in the tilted position;

Figure 8 is a cross sectional left side view of the platform elements in a semi-deployed position;

Figure 9 is a cross-sectional left view of the platform elements in their fully deployed position;

Figure 10 is a top cross sectional view taken along lines 10-10 of Figure 3 with partially cut away sections showing the platform forming mechanism;

Figure 11 is a front cross-sectional view taken along line 11-11 of Figure 10;

Figure 12 is a partial front cross sectional view taken along line 12-12 of Figure 10;

Figure 13 is a top plan view of the wheelchair with the platform fully deployed with partially cut away section exposing the platform forming mechanism;

Figure 14 is a partial lateral cross sectional view of the forward end of the platform with the stop flap in the horizontal position;

Figure 15 is a similar view with the stop flap in the erect position;

Figure 16 is a lateral cross sectional view of the device limited to the platform tilting mechanism shown in the step position;

Figure 17 is a similar view showing the platform in the deployed horizontal position;

Figure 18 is a similar view showing the platform in the tilted position;

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Figure 16 is a lateral cross sectional view of the device limited to the platform tilting mechanism shown in the step position;

Figure 17 is a similar view showing the platform in the deployed horizontal position;

Figure 18 is a similar view showing the platform in the tilted position;

Figure 19 is a schematic of the hydraulic system; and

Figure 20 is a schematic of the electrical system.

Description of the Preferred Embodiment of the Invention

Referring now to the drawing, and as an example of embodiment of this invention, there is shown a wheelchair lift device 1 mounted within the doorway of a public transit bus V. As illustrated in Figure 1 the wheelchair lift 1 in its stowed position forms the normal entrance steps A and B of the vehicle V. In the active lift configuration illustrated in Figure 2, the tread 5 of step A, the tread 3 of step B, and the normally vertical riser 4 between step A and step B, become part of the load-carrying surface 72 of the lift. Backwall 2 of step B which is normally out of sight in the step position, also becomes part of the load-carrying platform 72. More specifically, as shown in Figures 6 through 9 the load-carrying platform is made of several parallel sections 3, 4, 5 and 6 which are articulated along their edges so that they may be folded back into a step configuration whereby sections 3 and 5 become the treads of steps B and A, respectively, section 4 becomes the riser between them, and section 2 forms the back step 3. The articulation between the sections 2, 3, 4, 5 and 6 is provided by piano-type hinges 19, 20, 21 and 22 which allow sections 2, 4 and 6 to rotate from a horizontal position in the lift mode to a vertical position in the step mode.

The infrastructure of the lift 1 is formed by stationary, vertical guides mounted on each side of the doorwell. A carriage 32 riding up and down between these vertical guides supports the platform elements and their folding and unfolding mechanism. The vertical guides are part of a pair of columnar assemblies 10, 11, more specifically illustrated in Figures 4, 5, 10 and 12. Each columnar assembly 10, 11, comprises a vertical elongated tubular channel 13 bolted to the chassis of the vehicle V and a member 14 slidingly engaged within the channel and fastened to the carriage 32. Each tubular channel 13 has a generally quadrangular cross section, an outer lateral wall 62, and front wall 63, a back wall 64 opposite the front wall, and an inner wall 65 cut open to form an elongated aperture 66 through which the sliding member 14 penetrates the channel 13. A pair of ribs 67 are provided on the inside surface of the outer side wall 62 for strengthening purposes. The channel 13 can conveniently be made from one piece of aluminium extrusion. The sliding member 13 comprises a flat vertical support 68 mounted on a carriage 32 with strengthening gussets 69. The vertical support 68 holds a U-shaped element 70 whose dorsal section occupies the longitudinal opening 66 of the channel 13 with its lateral projections 71 extending into the channel 13. Elongated blocks 73 of synthetic hard material, preferably an ultra-high molecular weight polymer are used as bearing elements. Blocks 73 are mounted against the lateral

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projections 71. Each block 73 bears against portions of the three adjacent walls of channel 13. The movement of the bearing block 73 against the inside walls of the channel 13 creates an extremely smooth and stable sliding linkage between the moving carriage 32 and the stationary infrastructure of the lift. This particular design provides a much larger bearing surface area than the roller-type bearing feature in the prior art. Subsequently, this type of bearing structure can withstand a much heavier loading of the cantilevered platform, while allowing for a substantial narrowing of the columnar assemblies 10, 11. The strength and stability of the disclosed sliding linkage mechanism is such that it is conceivable to use only one supporting columnar assembly in order to support the platform carriage rather than two. Alternately, as illustrated here, one of the supporting columnar assemblies can have a greatly reduced height without loss of platform stability. In the preferred embodiment of the invention, the right columnar assembly 11, that is the most forwardly located in relation to the vehicle, has been lowered to the level of the vehicle dashboard. This feature is particularly useful when the lift is installed in the front door wel of a bus, where a high columnar assembly or other towering structure would interfere with the driver's field of vision.

The platform carriage 32 is lifted between the two columnar assemblies 10 and 11 under the action of a single hydraulic cylinder 80 conveniently housed inside the left tubular enclosure 13. The closed

end of the lift cylinder 80 is secured to one of the ribs 67. The end of the rod 81, as shown in Figure 7, is bolted to the base of the vertical support 68.

The carriage 32 comprises a vertical support 68 on each side of the platform bridged by a shelf-like base 33 supporting the skid plate 24. On the left side the base is attached to the vertical support 68 by means of the lift cylinder rod bolt 83 which engages the base bracket 77. The depth of the skid plate 24 does not exceed the depth of the door well. When the lift 1 is not in use all the platform elements and operating mechanisms are withdrawn above the skid plate 24 within the confines of the door well behind the closed doors D of the vehicle V. In the lift configuration, the carriage is expanded by a movable ramp 41 supported on each side by a pair of sliding beams 26. A series of roller bearings 28 are mounted on each side of the sliding beams 26. The inside rollers are captured by a U channel 29 attached to the side of the ramp 41. On the other side of the beam 26 the rollers 28 ride on another U channel 27 bonded to the lateral upbent 25 of the skid plate 24. As illustrated in Figure 13, the ramp 41 can be shifted outward beyond the forward edge of the skid plate 24 supported in a cantilevered manner by the beams 26 and rollers 28 assemblies. Section 2 of the platform 72 is attached to the back up bend of the skid plate 24 by a hinge 18. Section 5 of the platform 72 has two slots 31 cut immediately above the sliding

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beams 26. A pair of pins 30 projecting from the top surface of the beams 26 are captured within the slots 31. The pins 30 cause the step section 5 to be pulled outward when the ramp 41 is shifted under the action of hydraulic cylinders 37 and 38. The pin 30 and slot 31 arrangement also limits the travel of the sliding beams 26. The length of the slots 31 also defines the limits of the shifting movement of the ramp 41 in relation to the platform section 5. As illustrated in Figure 12, the ramp 41 is suspended to the platform section 5 by means of a pair of rollers 36 mounted underneath section 5 by angle brackets 35 and riding within channels 34 welded to the surface of the ramp 41. The maximum platform deployment is conveniently achieved by using two hydraulic cylinders 37 and 38 mounted back to back and activated simultaneously. The rod 40 of the forward-oriented cylinder 38 is attached to end piece 47 mounted on the forward edge of the ramp 41. The end of the backward oriented cylinder 37 is attached to a bracket 79 welded to the back portion of the skid plate 24. It can now be understood that by shifting the ramp 41 under the action of the combined cylinders 37 and 38, the multisectional platform 72 can either be deployed into a load-carrying surface or folded back into a step configuration within the door well of the vehicle V. At the forward end of the ramp 41 and attached to the end piece 47 is a pressure sensitive edge 49. The pressure sensitive edge 49 is made of resilient material surrounding air cavities

48. When the pressure-sensitive edge 49 is deformed, upon contact with an obstacle such as a sidewalk curb, the pressure change in the cavities 48 is used to trigger a safety switch. A safety flap 15 forms a slanted surface bridging the gap between the end of platform section 6 and the pressure-sensitive edge 49. The safety flap 15 can be raised as illustrated in Figure 15 under the action of a pair of hydraulic cylinders 43. The pull of the cylinder rods 44 is transmitted to the safety flap 15 by means of an articulated linkage comprising the safety flap gusset 16, lever 46 and arm 45. A pair of rollers 23 mounted on the side of each of the two arms 45, as shown in Figure 11, ride within a channel 74 at each lateral end of the ramp 41. The gussets 16 are pivotally attached to the arm 45 and to the lever 46. The lower end of lever 46 is pivotally connected to the forward edge of the ramp 41, as illustrated in Figure 15. During motion of the platform loaded with a wheelchair, the rods 44 are fully extended and the safety flap 15 is forced into an erect position, thus preventing the wheelchair from rolling off the platform. During platform folding and unfolding operations, section 3 is held horizontal by the effect of the parallelogram linkage constituted by braces 52 pivotally connected to the skid plate 24 at 56 and to the horizontal section 3 at 59, and the back section 2 of step B. The brace 50 parallel to brace 52, and similarly attached, is used in conjunction with lever 51 to reduce the stress on hinges 18, 19 and 20. A roller 58 attached to

the lower end of lever 51 rides on th top surface of the skid plate. When the ramp 41 is withdrawn, the back of the ramp 41 comes in contact with roller 58 to apply a lifting pressure upon platform section 3. A pressurized gas cylinder 53 is connected between the horizontal section 3 and the back of the ramp 41 in order to absorb any jitter between the movements of the platform and the ramp. For safety reasons, platform sections 2, 3, 4 and 5 are covered with mats 78 made of rubber-like, anti-skid material.

Illustrated in Figures 16 through 18 is an optional feature of the lift 1 which allows for a slight downward tilting of the platform 72 in relation to the base 33 and verticle support 68. This feature is particularly useful in situations where the level L of a sidewalk or loading docks is not far below the floor level F of the lift-equipped vehicle V. The platform 72 is deployed and then tilted slightly around a pivotal axis formed by a hinge 87 mounted between the forward edge of the base 33 and the bottom of the skid plate 24. The platform can then be used as a loading ramp not unlike the gangplank of a ship. The tilting motion is controlled by a hydraulic cylinder 85 connected between the lateral up bend 25 of the platform 24 and one of the vertical supports. The cylinder 85 can conveniently be housed within one of the tubular enclosures 13.

Referring now to Figure 19, I shall describe the hydraulic components of the device. Hydraulic fluid is drawn from reservoir

100 by motor pump 101 and sent through filter 103 and check valve 104 to feed the solenoid control valves 106, 107, 108 and 120. Each one of these valves has two alternate spring-loaded output gates controlled by solenoids. Valve 106 is used to control the operation of the safety flap cylinders 43. When solenoid 109 is energized, fluid is supplied to the back of the cylinder 43 through flexible line 115, causing the rods to extend out of the cylinders 43 and to raise the safety flap 15. Alternately, when solenoid 112 is energized, the fluid is supplied to the front of the cylinder's pistons, causing the rods to withdraw inside the cylinders and the lowering of safety flap 15. Valve 107 is used in the same manner to control the operation of the vertical lifting cylinder 80. Solenoid 110 controls the downward motion the rod while solenoid 113 is energized when the lift carriage has to be raised. Valve 108 is used to control the operation of the ramp cylinders 37 and 38 used to fold and unfold the load-carrying platform 72. Solenoid 111, when energized, causes the shifting forward of the ramp 41. Valve 120 is used to control the operation of the tilting cylinder 85. Solenoid 121, when energized, causes the downward tilting of the platform 72. Alternately, when solenoid 122 is energized, the platform is returned to the horizontal position. A spring-loaded hydraulic cylinder 116 is used to immobilize the lift in the stowed position when it is not operational. In the absence of fluid pressure, the rod 118 is pushed outward under the action of the compressed coil spring 117. The end

of the rod 118 is used to force a mechanical lock of the carriage in the stowed position. When fluid pressure is established, the rod 118 is withdrawn, removing the mechanical lock of the lift. A hand pump 102 is provided as a bypass of the motorized pump 101 in order to allow manual operation of the system in case of electrical power failure in the vehicle. Valves 106, 107 and 108 are also provided with handles for manual operation.

Referring now to Figure 19 in addition to Figure 20, I shall describe the operation of the electrical components of the wheelchair lift 1. The electrical power for the system is derived from the vehicle 12-volt battery 140 which is protected by a fuse 141. The power supply is first run through a switch 142 which closes only the vehicles doors are fully open; then through the normally closed STOW switch 144 before reaching the master ON/OFF switch 143. When the master switch 143 closes, solenoid 158 is energized through closure 157 of relay R-1. Solenoid 158 controls an air valve which sends pressurized air into the cavity 48 of the pressure-sensitive edge 49 at the forward edge of the platform 41. The increase in air pressure in the pressure-sensitive edge 49 causes the closure of switch 150. At this point, the coil 155 of relay R-1 is energized through diode 164. The air valve solenoid 158 is de-energized, causing the pressurized air to bleed out of the sensitive edge 49 and reopening switch 150. The relay coil 155 is kept energized through closure 156, and a green light indicator 159

is lit through closure 157. Power is also applied to solenoid 161 which controls a valve in the vehicle door mechanism preventing the doors from being closed while the lift is operated. The platform 72 can now be deployed or withdrawn by manipulation of switch 148 which energized solenoid 114 or 110 controlling the ramp cylinders valve 108. Once the platform section 3 is lowered to the level of platform section 5, switches 137 and 138 close. The safety flap 15 can be raised or lowered by way of switch 135 which energizes solenoid 109 or 112 controlling the operation of the safety cylinders valve 106. With the safety flap control switch 135 and 136 in the LOCK position, the platform can be lowered or raised by operation of the UP/DOWN switch 139 which energizes solenoid 110 or 113 controlling the lifting cylinders valve 107. The forward movement of the platform 72 will be interrupted by the opening of switch 146 when the platform reaches of the level of the vehicle floor F. A pushbutton bypass switch 147 allows the operation of the lifting cylinders regardless of the position of the platform element 5 or that of the safety flap 15, by bypassing switches 136 and 138. If during the unfolding or lowering of the platform 72, an obstacle comes into contact with either the sensitive edge 49 or the bottom of the skid plate 24, switch 150 or 149, respectively, are closed. Any one of these switch closures will energize coil 152 or relay R-2 causing immediate interruption of the platform movement, and lighting of red indicator 160. At this point, the operator

must flip switch 148 to the IN (folding) position or switch 139 to the UP (lifting) position. Either one of these maneuvers energizes coil 151 or relay R-2 through diode 162 or diode 163, which in turn counteracts the effect of coil 152 allowing count out closure 153 and 154 to return to their normal state. If the driver wants to return the lift structure to its stowed location in relation to the bus floor, he activates the STOW switch 144. He can now operate the lift only so long as switch 145 remains closed. Switch 145 will open as soon as the carriage reaches its proper stowed position. A switch 170 which opens only when the ramp 41 is fully withdrawn into the inward portion of the carriage 32, keeps the door control valve solenoid 161 energized preventing the closure of the doors until the platform elements have returned to the step configuration. Switch 125 is used to energize solenoid 122 of 121 in order to tilt the platform 72 downward or raise it back to the horizontal position. The various manually controlled switches and indicators are mounted on a panel installed on the dashboard of the vehicle or at any convenient place readily accessible to the driver.

While I have described one of the preferred embodiments of my invention and its application in the entrance door well of a transit bus, other embodiments and other applications may be devised and modifications may be made thereto without departing from the spirit of the invention and from the scope of the appended claims.

1. A device acting alternately as a load-carrying lift or as a step structure between a lower level and an upper level which comprises:

a multi-sectional load-carrying platform having at least three contiguous sections;

means for articulately connecting each section to any other section contiguous to it;

means for supporting the platform;

means for moving the platform between the lower level and the upper level;

means for rotating at least one section to a substantially vertical position and for placing any other section contiguous to said rotatable section into a substantially horizontal position, each at a different level, whereby said vertically and horizontally positioned sections form a step structure;

said means for moving comprising:

a vertical columnar guiding assembly on one side of the platform;

said columnar guiding assembly having two slidingly engaged elements, one element being attached to the side of the platform, the other element being part of a stationary supporting structure for the lift.

2. The device claimed in Claim 1 wherein one of said slidingly engaged elements comprises:

a vertical channel;

the other said slidingly engaged element comprises a member captured within said channel; and

said guiding assembly further comprises a bearing block between said member and said channel.

3. The device claimed in Claim 2 wherein:

said channel comprises an elongated vertical tubular enclosure having a longitudinal opening along one side and inside bearing surfaces;

said slidingly engaged element comprises a bracket penetrating the tubular enclosure through the longitudinal opening; and

at least one elongated bearing element fastened to the bracket and acting against the inside bearing surface of the tubular enclosure.

4. The device claimed in Claim 3 wherein:

said elongated tubular enclosure has a generally quadrangular cross-section, a front wall, a back wall opposite the front wall, a first lateral wall, and a second lateral wall having the longitudinal opening therein;

said bearing element comprises a block of hard synthetic material shaped and dimensioned to bear against the inner surfaces of at least three of said walls.

5. The device claimed in Claim 1 wherein:

said multi-sectional platform comprises at least first, second, and third parallel sections laid side by side wherein the second section lies between the first and third section;

means for pivotally articulating the first section in relation to the second section about a first axis located along their adjacent edges;

means for pivotally articulating the third section in relation to the second section about a second axis located along their adjacent edges;

means for placing the first and third sections to a substantially vertical position; and

means for maintaining the second section in a substantially horizontal position between and above said substantially vertical

sections while rotating said first and third sections about said axis.

6. The device claimed in Claim 5 wherein said multi-sectional platform comprises:

a fourth section adjacent to the third section;

means for pivotally articulating the third section in relation to the fourth section about a third axis located along their adjacent edges; and

means for supporting said multi-sectional platform.

7. The device claimed in Claim 6 wherein said means for supporting comprises:

a carriage having an inward portion supporting the first section;

a cantilevered outward portion supporting the fourth section; and

means for pivotally articulating the first section in relation to the first portion of the carriage about a fourth axis located substantially along the inward edge of the first section.

8. The device claimed in Claim 7 where said cantilevered portion comprises:

a support plate;

a beam on each side of the plate;

means for slidingly connecting each beam to one side of the plate; and

means for slidingly connecting each beam to the inward portion of the carriage whereby the beams and support plate can be slightly telescopically inward within the confines of the inward portion of the carriage.

9. The device claimed in Claim 8 which further comprises:

means for articulately connecting the first section to the support plate; and

wherein said means for placing comprise at least one hydraulic cylinder associated with the carriage for withdrawing the support plate beams toward the inward portion of the carriage.

10. The device claimed in Claims 4 or 9 wherein said means for moving the platform comprises a hydraulic cylinder within said columnar guiding assembly applying a vertical motion to said carriage.

11. The device claimed in Claim 8 wherein said support plate comprises:

a transversal member along the forward edge of the support plate;

a flap parallel to said transversal member laid flat along the forward edge of said support plate; and

means for placing said flap to a vertical position, whereby it forms a vertical barrier near the forward edge of the platform.

12. The device claimed in Claim 7 wherein said inward portion of the carriage comprises:

one horizontal shelf fastened to one slidingly engaged element on each side of the platform;

a generally horizontal support plate resting above said shelf; and

means for tilting said support plate and said outward portion downward in relation to the shelf.

13. The device claimed in Claim 12 wherein said means for tilting comprises:

means for articulately connecting the support plate to the shelf; and

at least one hydraulic cylinder for tilting the support plate

in relation said slidingly engaged elements attached to the side f the platform.

FIG. 1

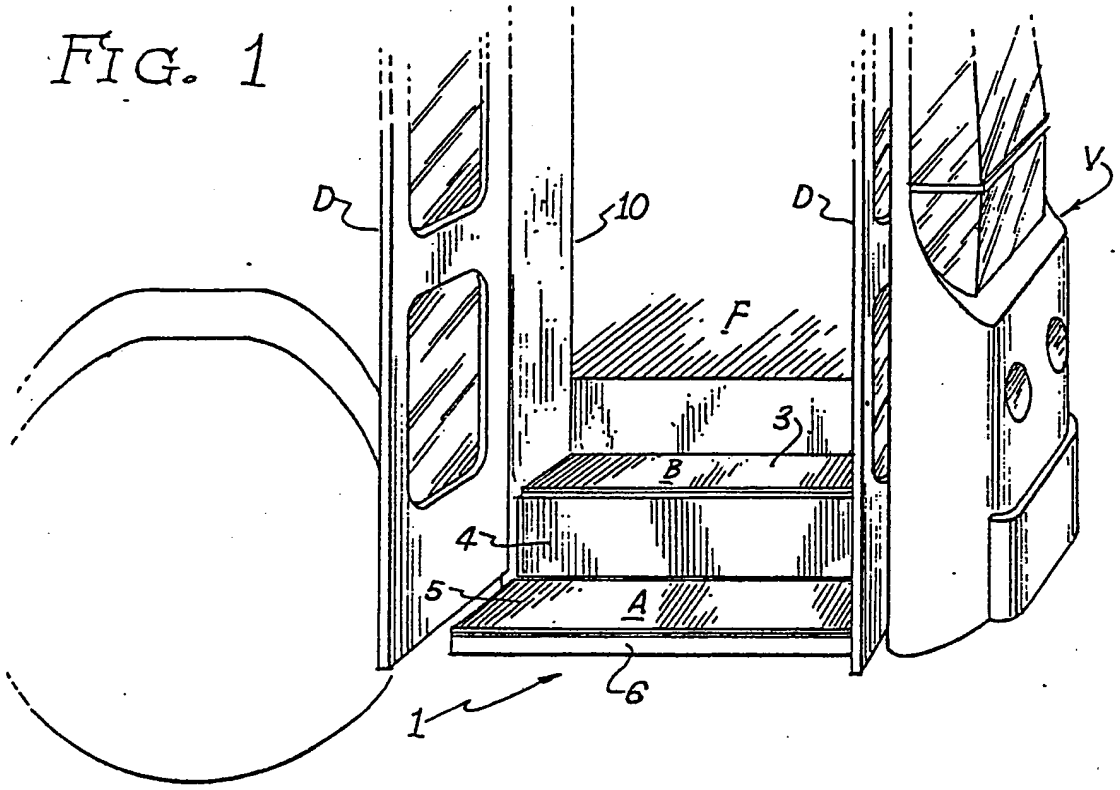


FIG. 2

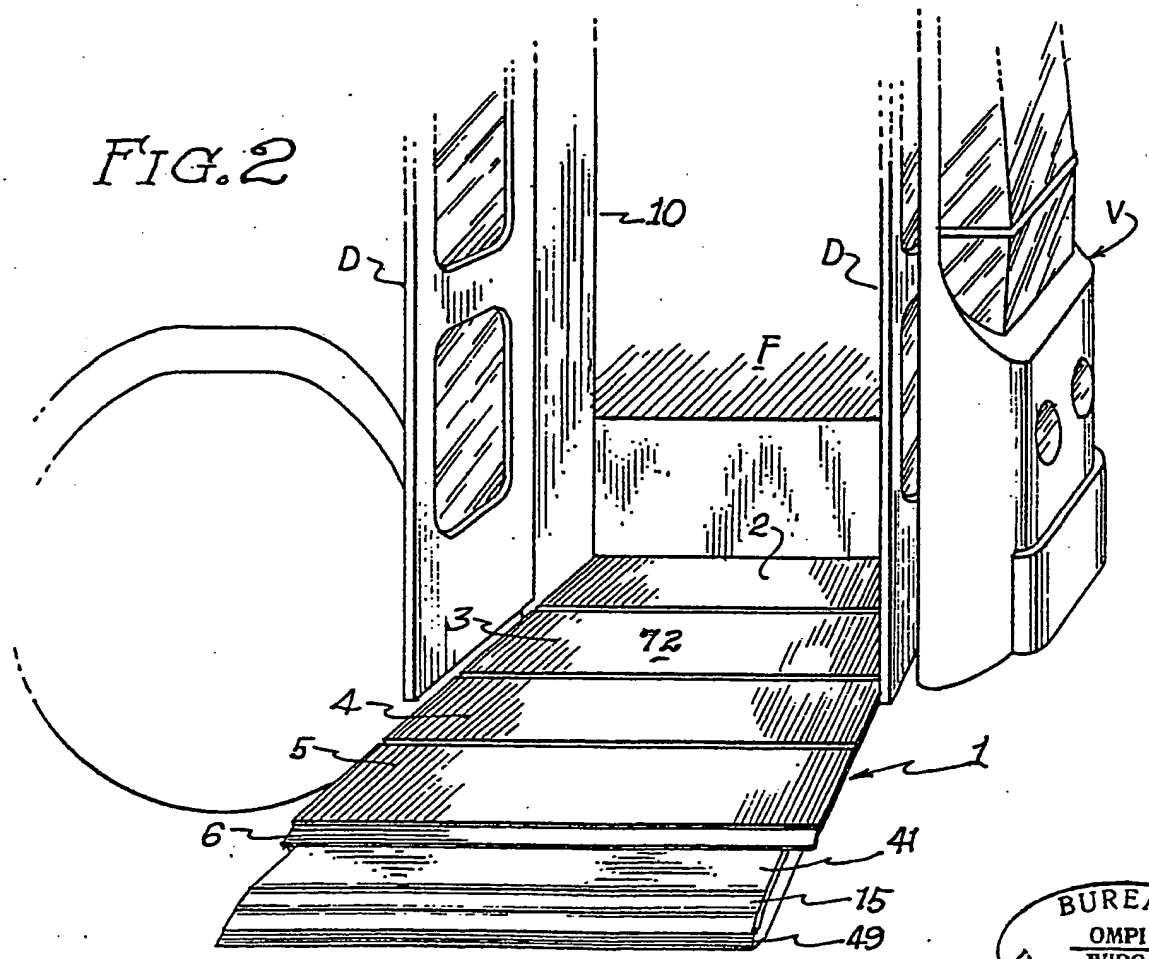


FIG. 3

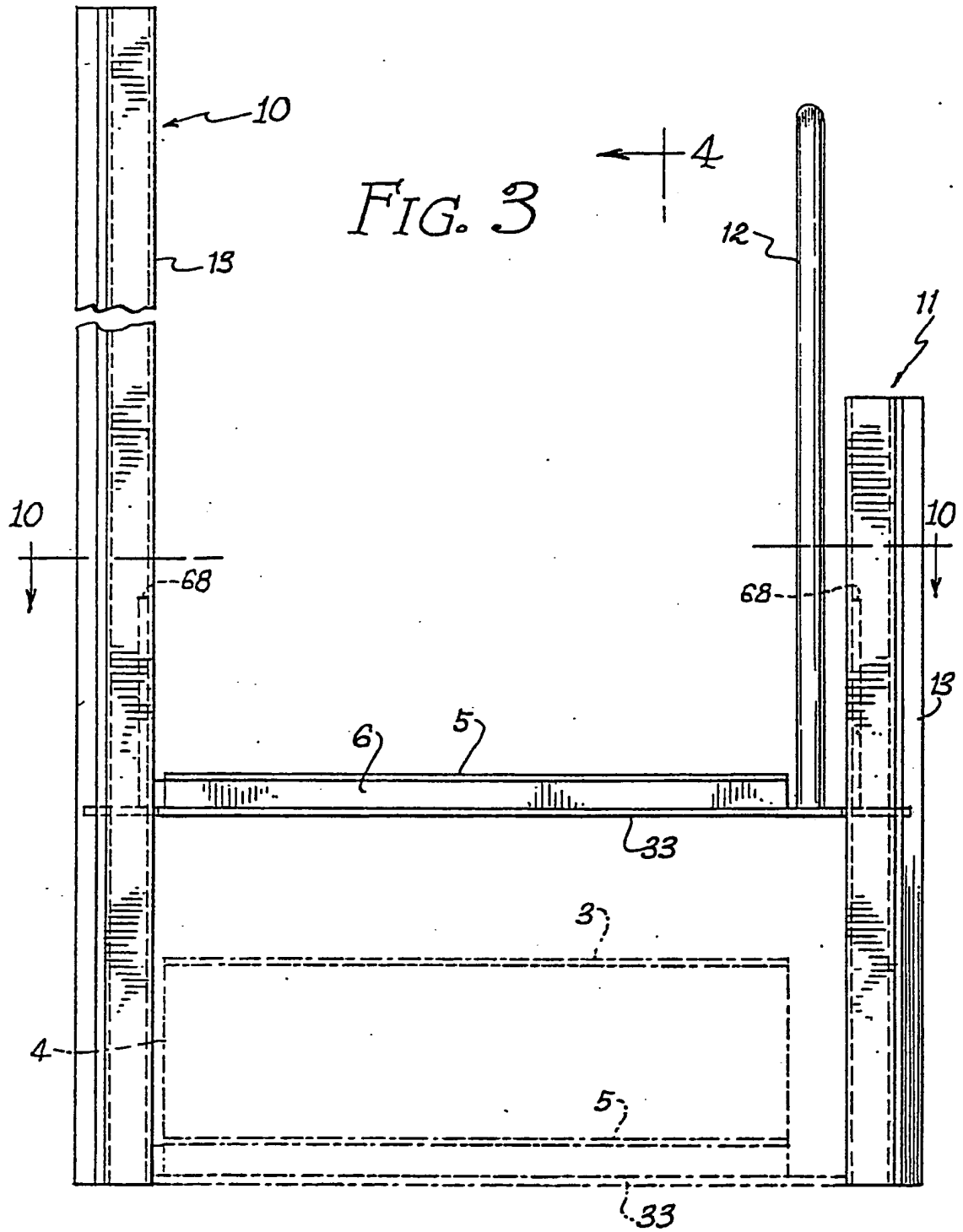


FIG. 4

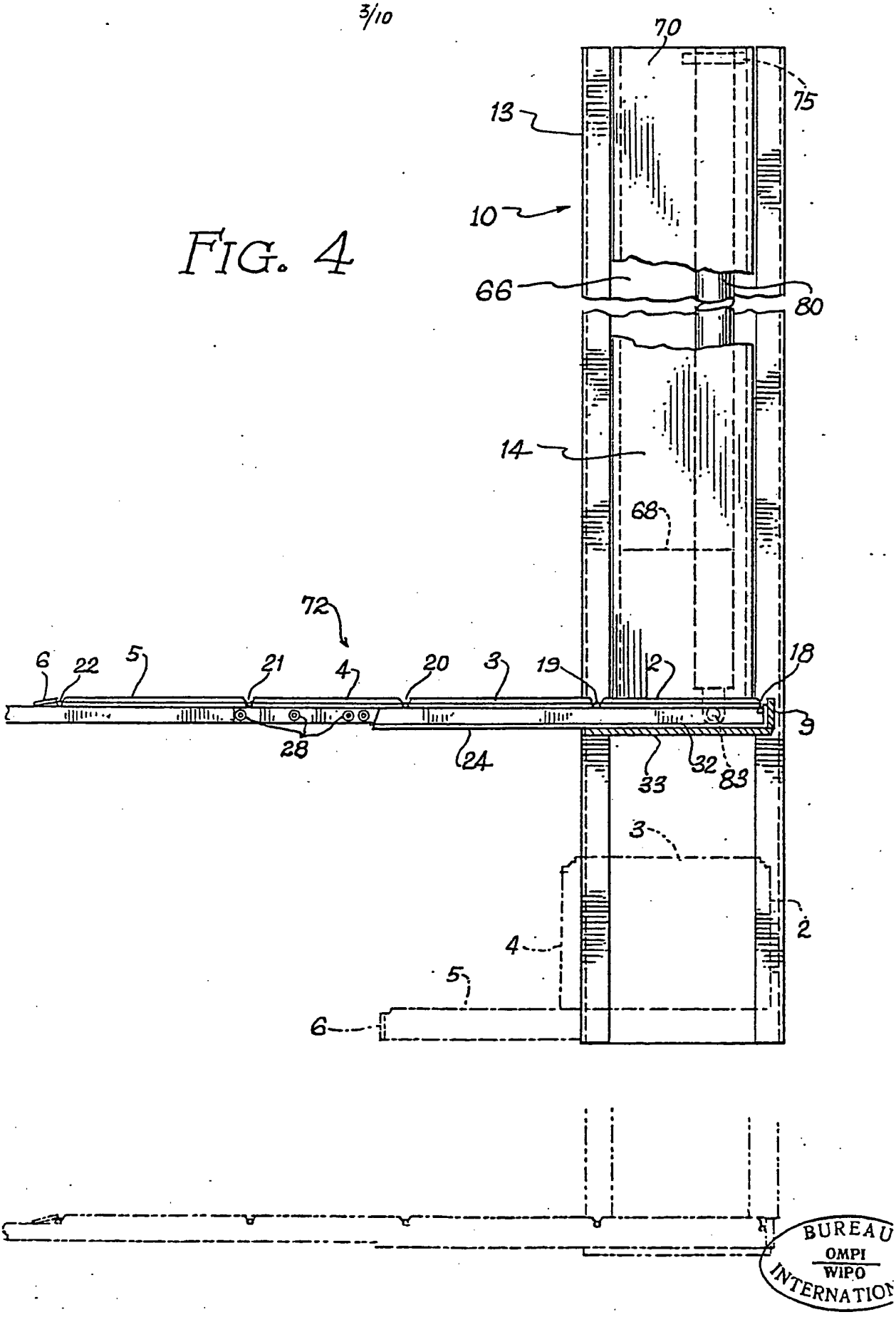
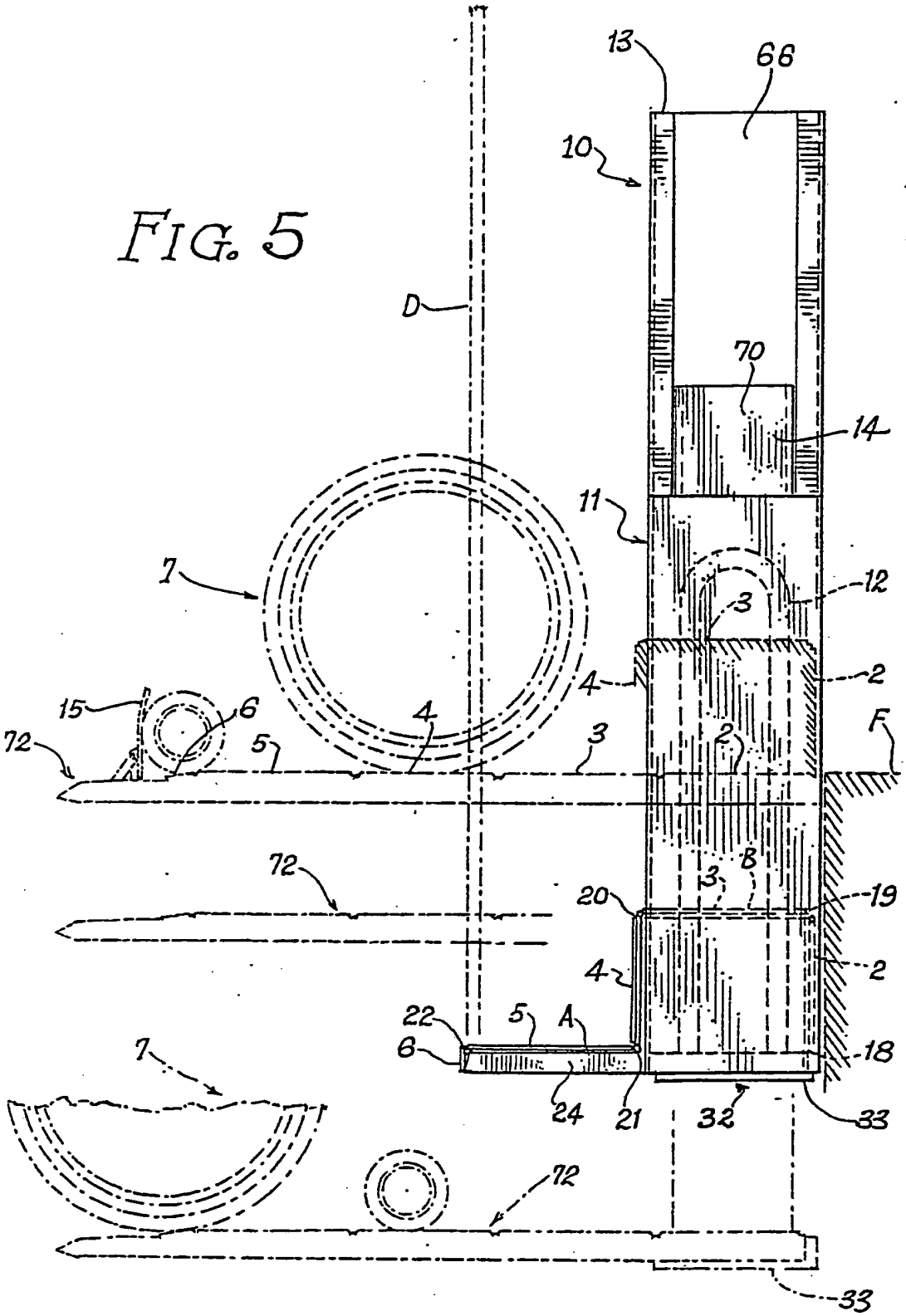


FIG. 5



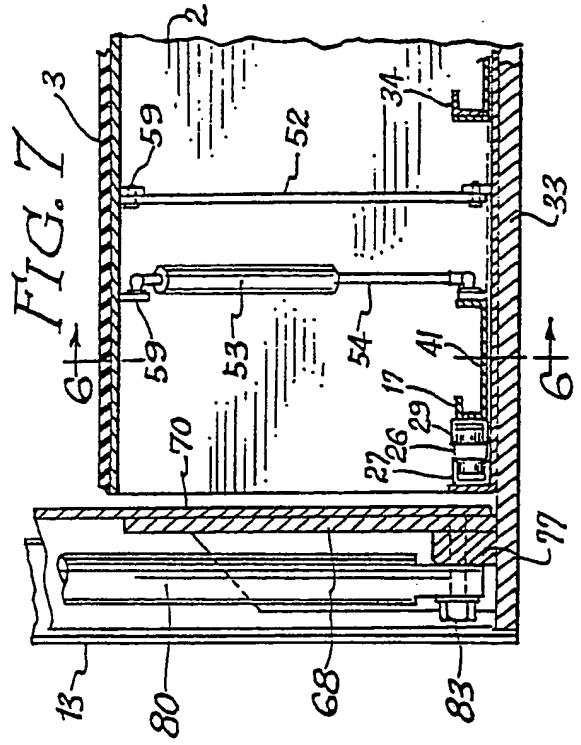


FIG. 7

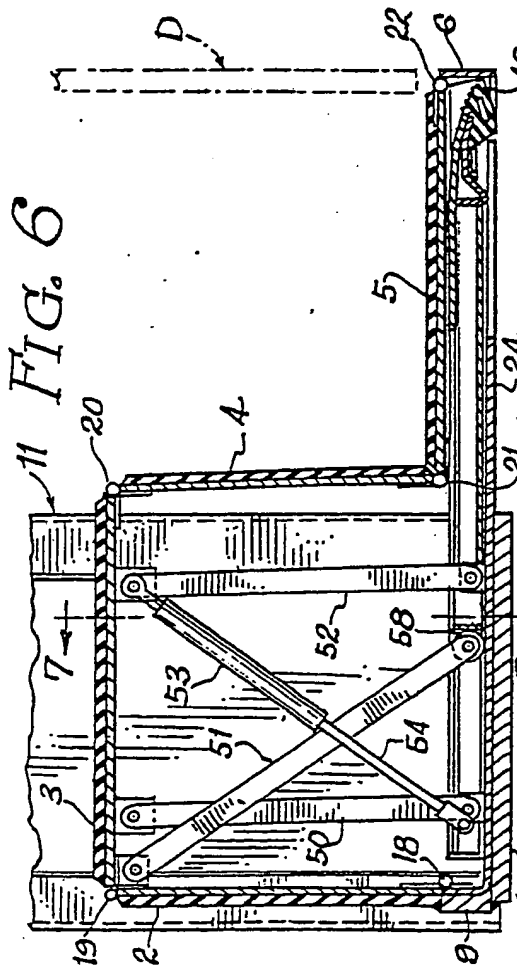


FIG. 6

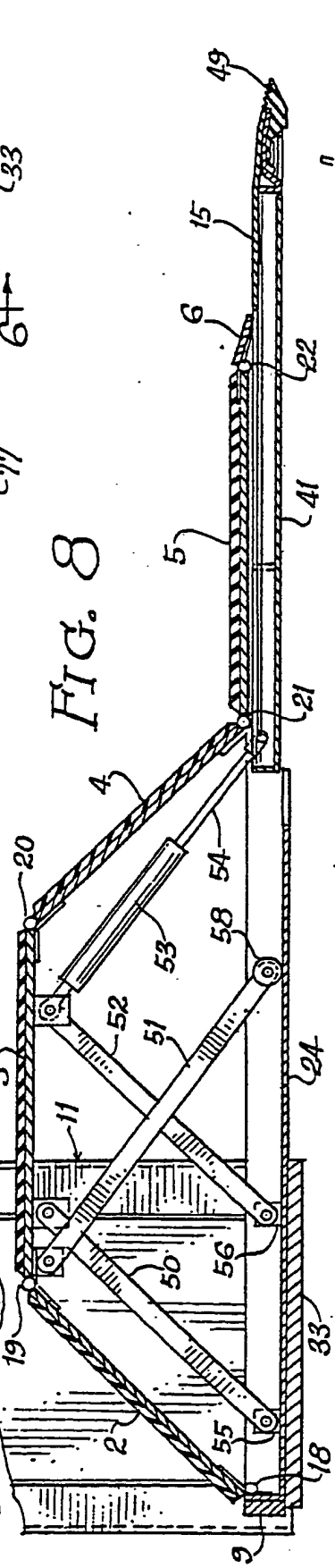


FIG. 8

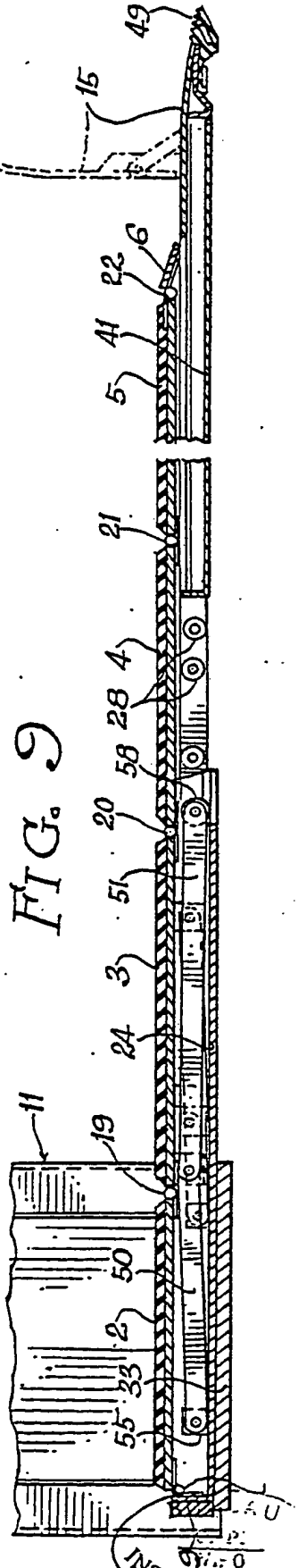


FIG. 9

FIG. 10

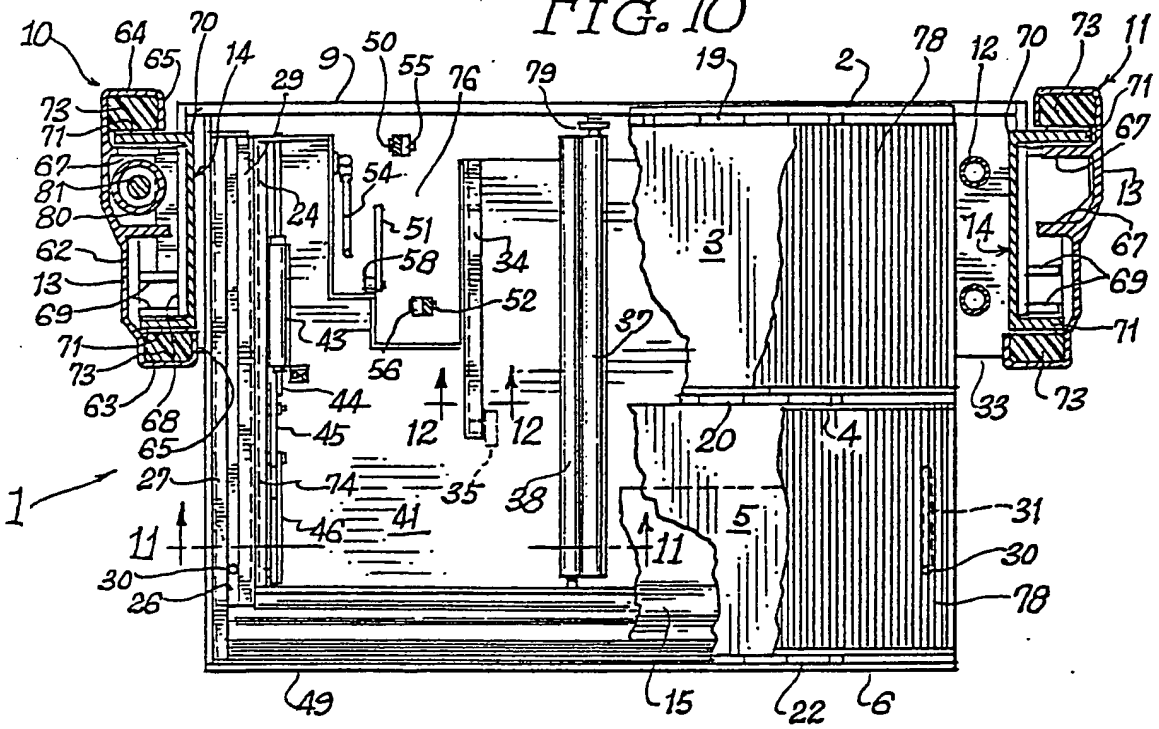
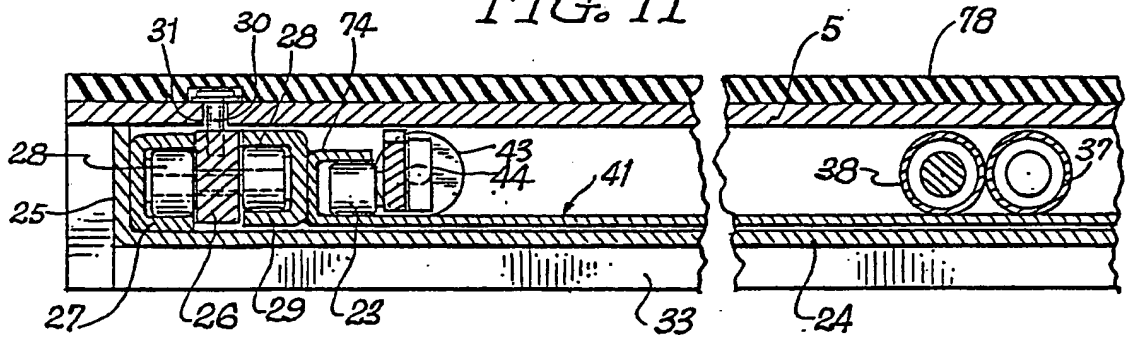


FIG. 11



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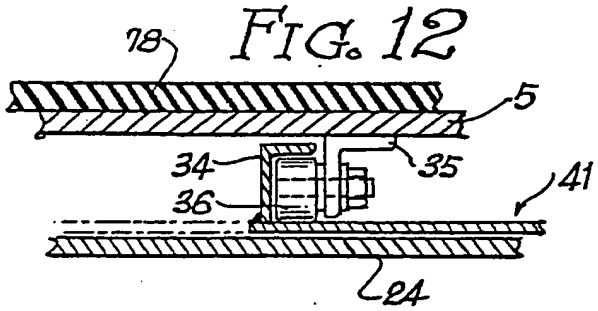


FIG. 13

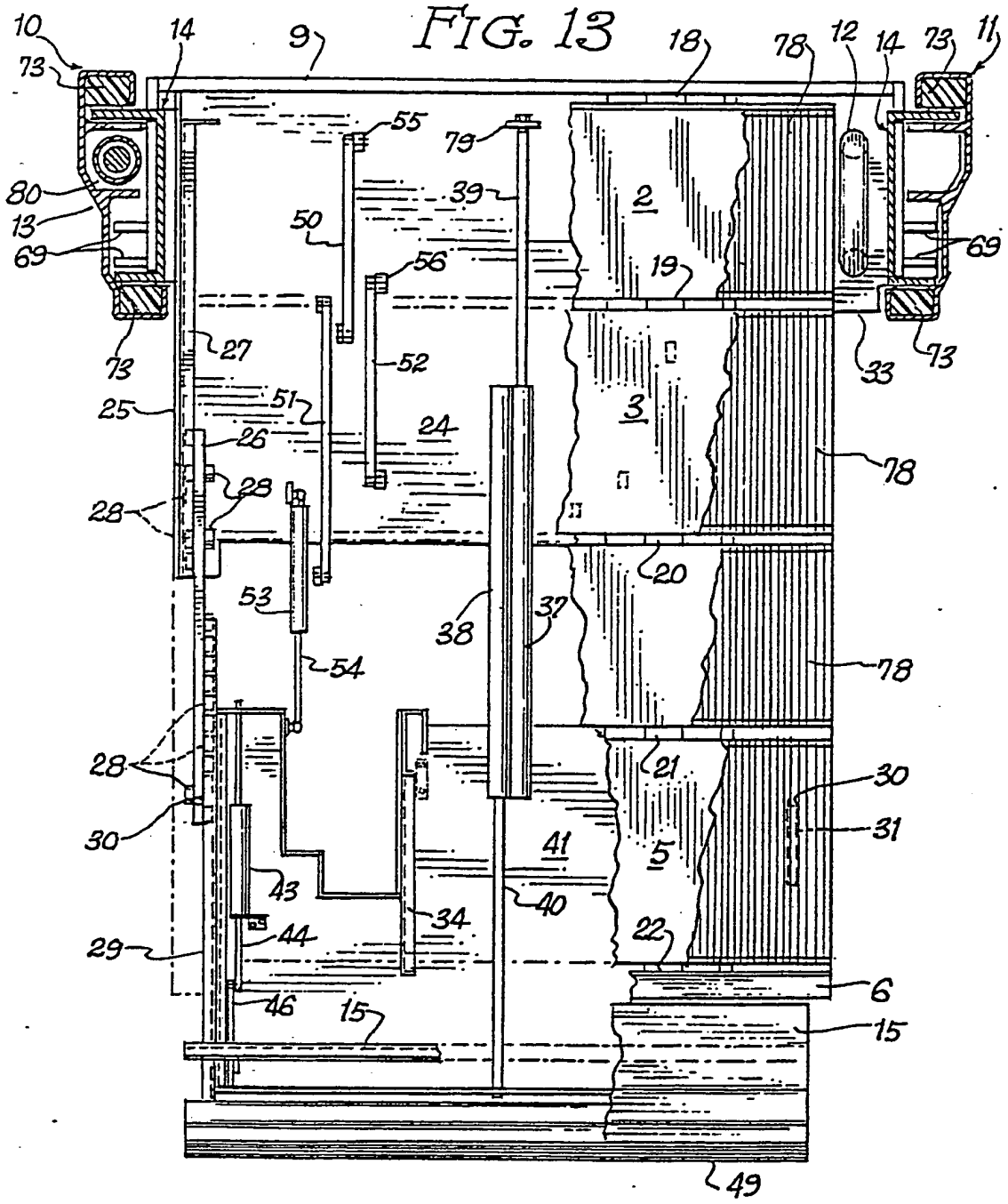


FIG. 14

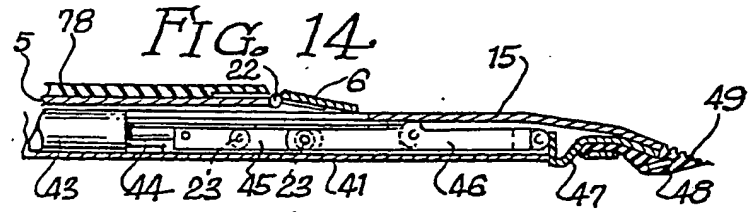
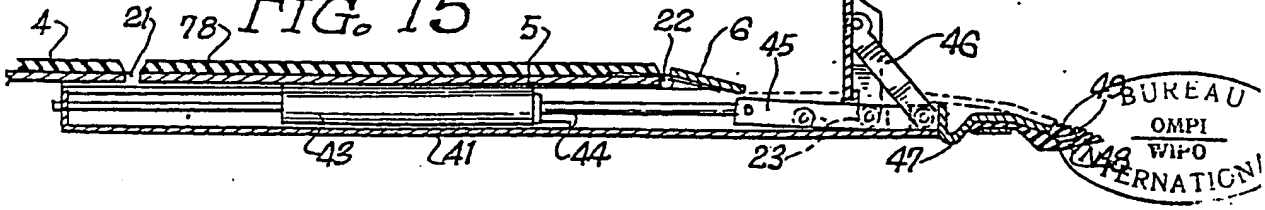


FIG. 15



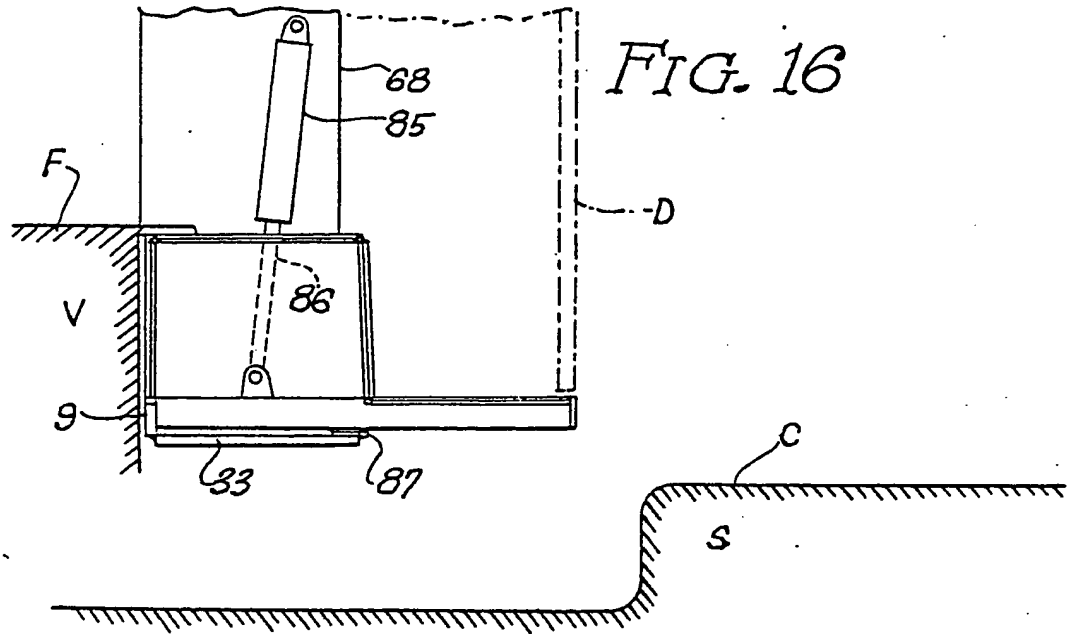


FIG. 16

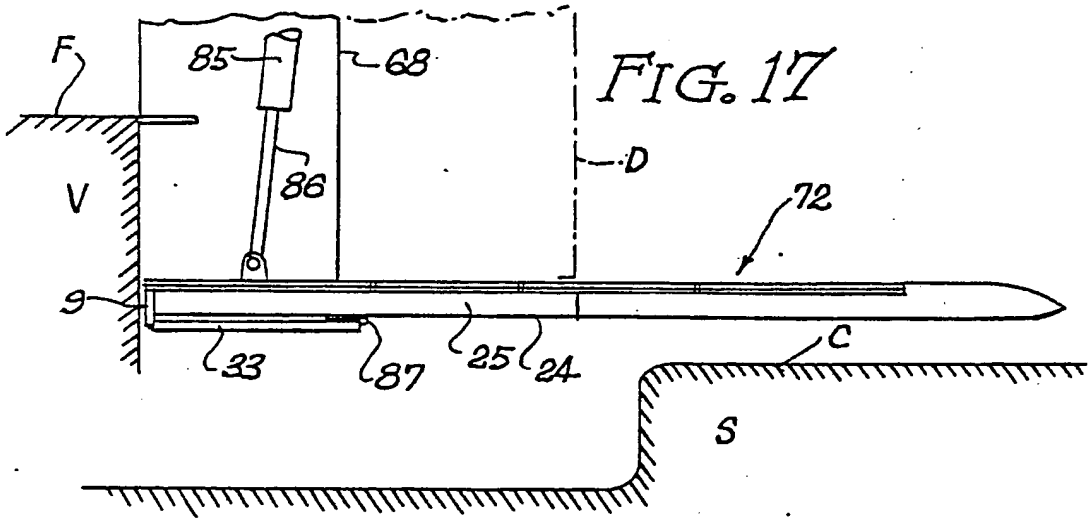


FIG. 17

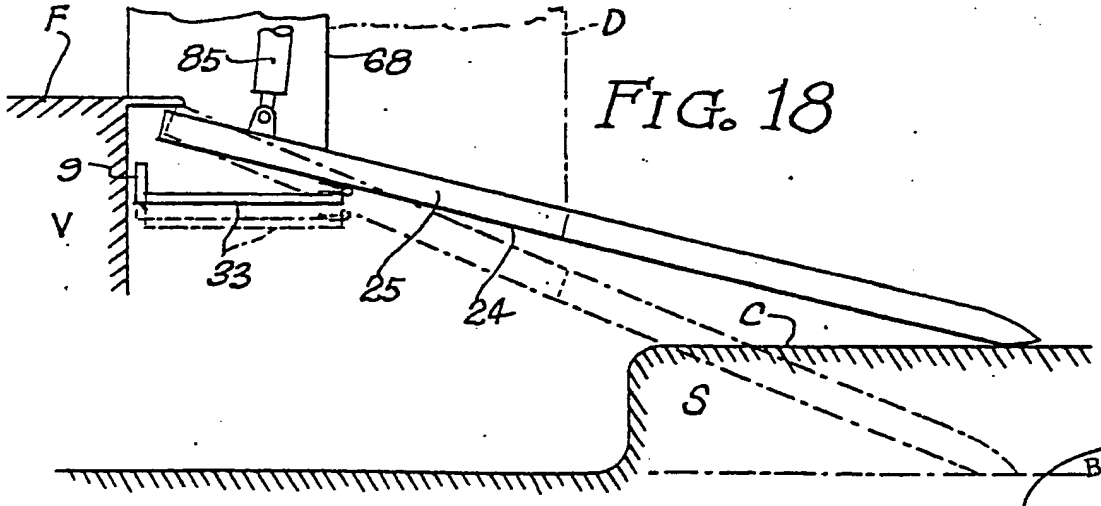


FIG. 18

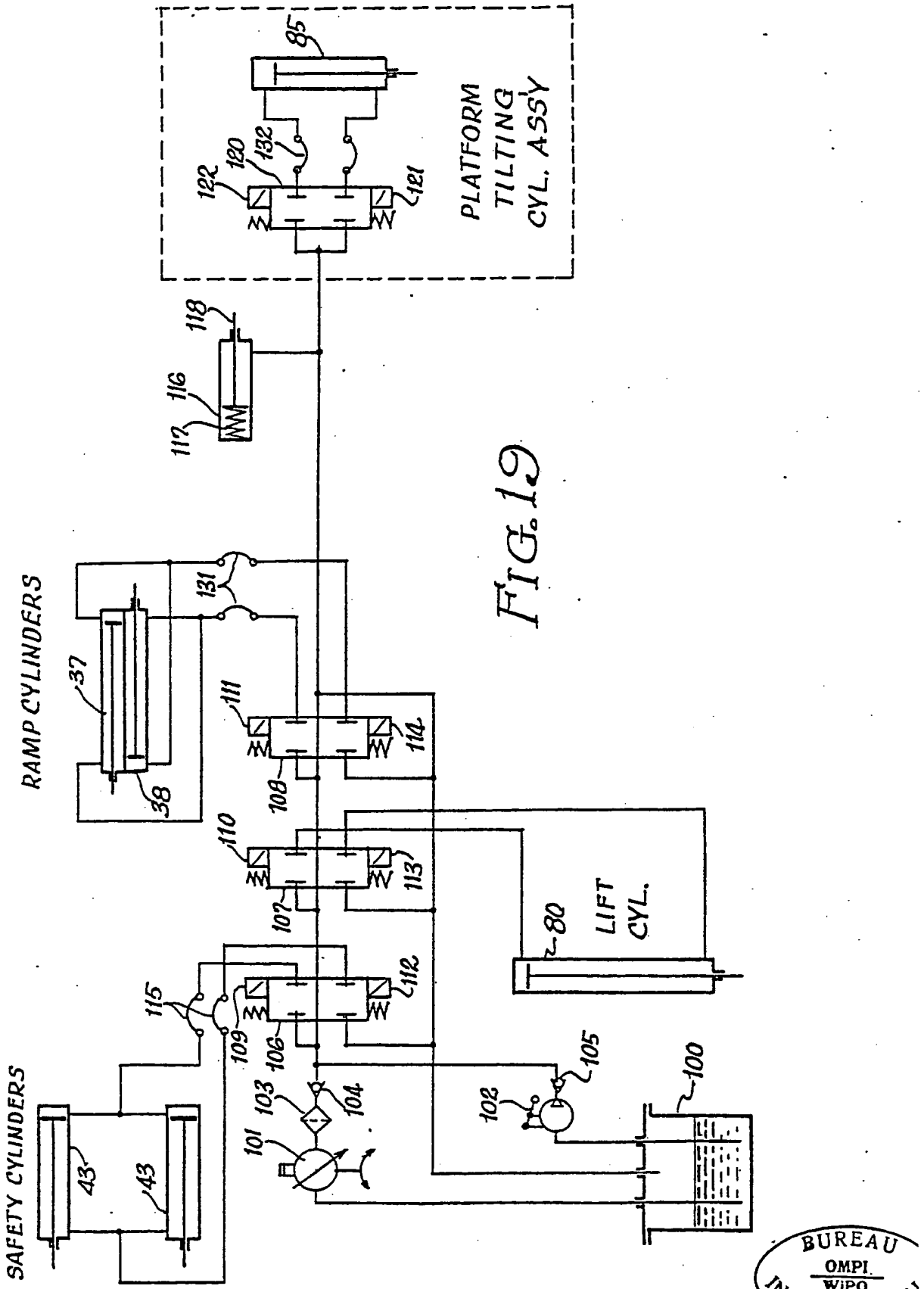


FIG. 19

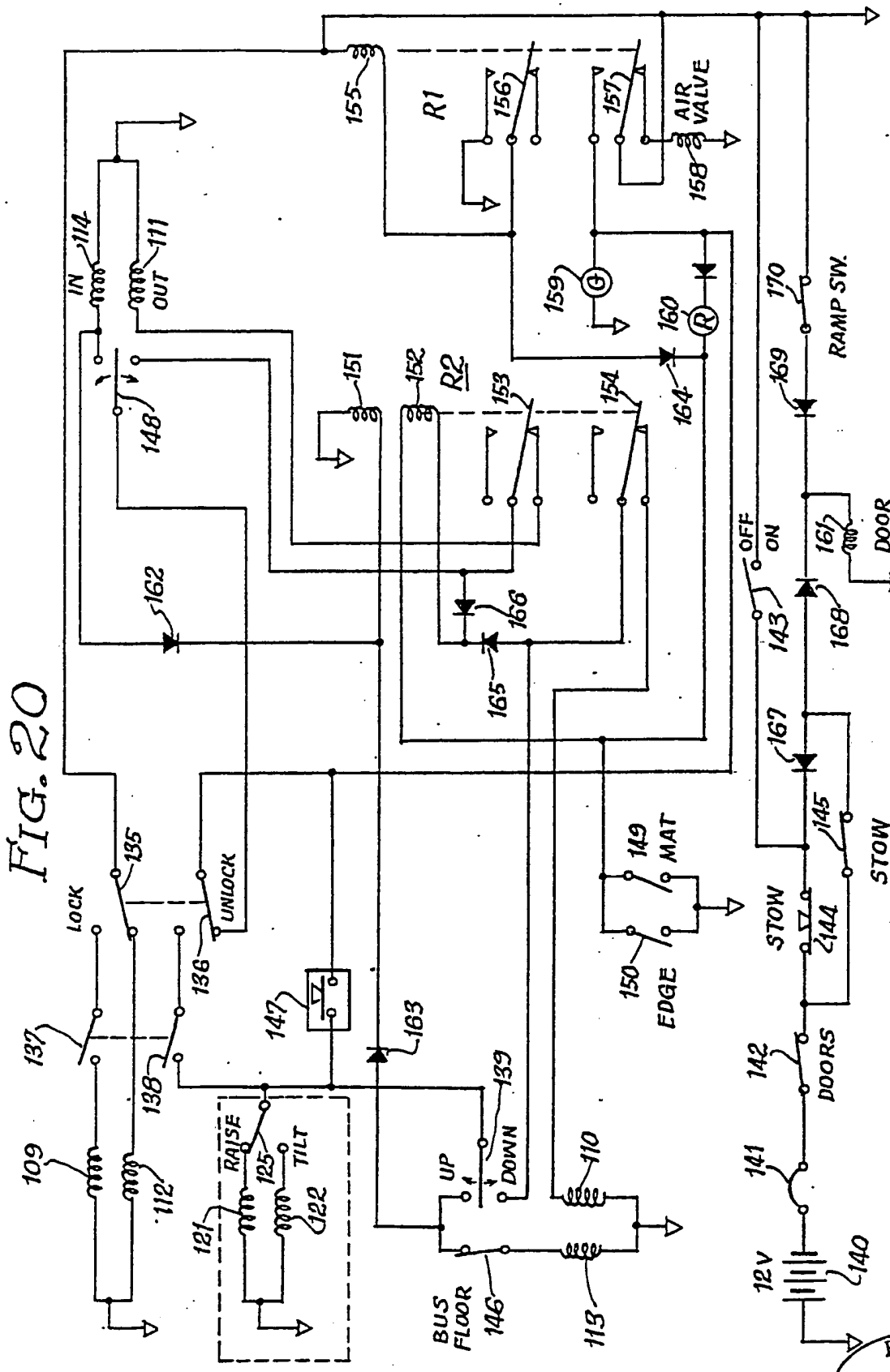


FIG. 20

INTERNATIONAL SEARCH REPORT

International Application No PCT/US80?00112

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL. B60P 1/46
US. CL. 414/545

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	414/540,545; 105/341,430-431,437-438,447-448,443 296/178; 280/163-164,166; 182/91,95

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	US, A, 4180366, Published 25 December 1979	1-13
A	US, A, 4027807, Published 7 June 1977	1-13
A	US, A, 4176999, Published 04 December 1979	1-13
A	US, A, 4081091, Published 28 March 1978	1-13
A	US, A, 4168134, Published 18 September 1979	1-13
A	US, A, 3957284, Published 18 May 1976	1-13

* Special categories of cited documents: [15]

"A" document defining the general state of the art

"E" earlier document but published on or after the international filing date

"L" document cited for special reason other than those referred to in the other categories

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but on or after the priority date claimed

"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention

"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
12 September 1980	14 OCT 1980
International Searching Authority [1]	Signature of Authorized Officer [20]
ISA/U.S.	Brian J. Bond

Form PCT/ISA/210 (second sheet) (October 1977)